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ABSTRACT

The differences in raw scores between two versions of the Standard Progressive Matrices Test (SPM) and differences in available norms for one version and the currently studied population were investigated. The SPM was originally designed to measure the general factor of intelligence unrestrained by language. Scores for the untimed SPM version published in Britain in 1983 (SPM British) and the timed SPM version published by the Australian Council for Educational Research (SPM-ACER) were compared for 107 male corrective trainees (Maori, European, and Pacific Islanders) in New Zealand ranging in age from 16 years to 20 years 4 months. Norms for the SPM-ACER for Australian prison inmates and norms for the SPM British for children in New Zealand aged 8 to 16 years were compared for use for the New Zealand offenders. Both forms of the SPM were found equivalent in relation to use by the population sampled in this study, but the two sets of norms were not equivalent. It is suggested that the SPM-ACER should be abandoned for the study sample because the norms appeared to grossly inflate the performance levels of these corrective trainees. The use of the SPM British and New Zealand norms was recommended. Instructions for the comparative testing are included. (SLD)

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REPORT ON THE USE OF THE STANDARD PROGRESSIVE MATRICES WITH MALE CORRECTIVE TRAINEES

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REPORT ON THE USE OF THE *STANDARD PROGRESSIVE MATRICES* WITH MALE CORRECTIVE TRAINEES

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As an introduction to this report it may be considered helpful to discuss the *Standard Progressive Matrices* (J C Raven, 1938) and its uses in the context of contemporary thought on general ability assessment.

Three versions of this test are referred to in the present report:

(1) The *Standard Progressive Matrices* (J C Raven, 1938) published in Great Britain by H K Lewis, restandardised in 1979, with an updated manual written by Raven, Court and Raven published in 1983. Hereafter this is referred to as the *SPM (British)*. This version is untimed.

(2) The *Standard Progressive Matrices* (1938) published (by arrangement with J C Raven) by ACER. Norms in this manual are based on a *timed* version of the *SPM*. Hereafter this is referred to as the *SPM (ACER)*.

(3) The *Standard Progressive Matrices - New Zealand Standardization* - a New Zealand standardization of the *SPM (British)*, published by NZCER in 1984, and including a *New Zealand Norms Supplement*. Hereafter this is referred to as the *SPM (NZ Standardization)*.

The *SPM* is a test originally designed to measure intellectual functioning in the context of Spearman's (1927) concept of 'g', the large general factor of 'intelligence' unrestrained by language. Spearman maintained that all intellectual activities shared a single common factor of 'g' along with their own 's', or specific factor. Positive correlation between two tests was considered to be related to the common 'g' factor. Spearman considered that a test that tried to measure solely 'g' was the most powerful indicator of a person's intellectual capacity. He further concluded that tests dealing with abstract relations best measured the concept of 'g' (Anastasi, 1976). It is now accepted however, that, in part, non-verbal and verbal tests of ability tap different cognitive functions. While there may be some overlap, success on a non-verbal measure does not necessarily equate with high scholastic aptitude or achievement. The British manual for the *SPM* (1979) reports correlation coefficients with the *Stanford-Binet Intelligence Scale* and the

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Weschler Intelligence Scale for Children - Revised in the range of +0.54 and +0.86 with English speaking children and adolescents. The same manual reports lower inter-test correlations in recent cross-cultural research with non-English speaking children and adolescents (a range of +0.30 to +0.68). With adults in different cultures the manual considers that more research is required before reliable conclusions may be drawn regarding the validity of *SPM* in different cultural settings. In relation to concurrent scholastic achievement the British manual reports generally much lower correlations.

It may be argued that the use of the *Standard Progressive Matrices* is helpful in estimating general ability in educationally disadvantaged or culturally different groups, as the test appears to be free from obvious cultural influences. The 1979 standardization of the *SPM (British)* concludes that with English-speaking children only 9% of the within-age variance may be accounted for by social background and that the test works or 'scales' in the same way for children from different socio-economic levels (Raven et al, 1979). Others take different viewpoints. Cohen (1969) contests that non-verbal tests are not culture-free as they depend on the ability to reason logically, an ability considered intrinsic to middle class ways of thinking. Anastasi (1976) notes that studies in a number of non-European cultures have raised doubts about the suitability of the *SPM* for groups with very dissimilar backgrounds. In such groups the test was found to reflect the amount of education and additionally was susceptible to considerable practice effect. Such findings could be important considerations for Justice Department use of the *SPM*.

Given the aforementioned constraints of the role of cultural differences and the nature of non-verbal intelligence, results from the *SPM* must be subject to careful interpretation. The test can still however provide useful information complementary to other assessments of an individual's functioning and ability, particularly with subjects who find the verbal nature of many tests difficult. Given too, that the test can be group administered, requires little instruction and is relatively brief, the *SPM* continues to hold a place in assessment procedures.

The Justice Department of New Zealand is one of the many users of the *Standard Progressive Matrices*, and every new prison inmate is

administered the test as part of an initial assessment battery. Up until the present time they have used the *SPM (ACER)* which, as previously mentioned, is a timed test. Norms are reported from an Australian standardization in 1952 and 1953, and inmates results on the *SPM (ACER)* are transformed to a 1-5 scale, based on the ranges shown in Table (1).

TABLE 1 *Ranking Scale on SPM Performance for New Zealand Prison Inmates, Based on ACER Norms Collected 1952-1953* (taken directly from information provided by the Department of Justice)

Scale Number	1	2	3+	3	3-	4	5
Raw Score Range	50+	49-46	45-44	43-27	36-35	34-20	-20
IQ Range (ascribed to the score)	135+	123	115	110	99	96	86-

Based on the 1952-1953 *ACER* norms a report from Manawatu and Waikeria Youth prisons indicated that inmates from those two prisons showed a distribution of *SPM* scores to be positively skewed, i.e., *SPM* scores of inmates were a little better than *SPM* scores of the normal population (taken from documents provided to past prison education officers and made available by Mrs S Mortlock, Arohata Women's Prison).

In the last few years however, new normative data for the *Standard Progressive Matrices* has become available. The 1979 British standardization took place after a number of studies indicated that there had been some increase in *SPM (British)* scores since the earlier data was published. One of the main findings of the British standardization was to confirm this acceleration in development (particularly in younger children) and also some increase in the level at which scores obtained by less able people plateaued (Raven et al, 1983). Later investigations in New Zealand by NZCER showed that overseas norms were inappropriate to New Zealand, and normative data for the British version of the *SPM* was collected from New Zealand children aged between 8 and 16 years. Data has not been collected from those 16 and over and out of the school environment however.

The Justice Department approached NZCER with three questions in mind:

(1) How equivalent are the two forms, the *SPM (British)* and the *SPM (ACER)*?

(2) How comparable are the available Australian norms with the recent New Zealand norms?

(3) Which form of the test and which set of norms are most appropriate for use with corrective trainees?

Accordingly the difference in raw scores between the *SPM (ACER)* and the *SPM (British)* and the differences in percentile rank distributions between available *SPM (ACER)* norms and the New Zealand norms were investigated.

METHOD

Subjects

One hundred and seven male corrective trainees in two institutions were given both forms of the test during the second half of 1986. The age range of the subjects was 16.0 years to 20 years 4 months. Of the 107 subjects, 70 were Maori (65%), 32 were European (32%), and 5 were Pacific Islanders (5%). Twenty percent of the subjects left school from the third form, 40% from the fourth form, 24% from the fifth form, 1% from the sixth form, with information provided by 15% being unclear. Only 5% stated that they had had any success with external secondary school examinations.

Materials

Two forms of the *Standard Progressive Matrices* were used - the *SPM (ACER)* and the *SPM (British)*. Additionally a questionnaire requested age, ethnic origins, time at secondary school, date of leaving school, last secondary form attended and any examination qualifications gained.

Procedure

All 107 inmates were given both of the previously mentioned forms of the *SPM*, with approximately five days between each test. Education officers at the two institutions were instructed to alternate the order in which the tests were given. Accordingly half should have completed the *SPM (ACER)* and half the *SPM (British)* first. A copy of the instructions given to education officers in the institutions is contained in Appendix (1).

RESULTS

Comparing the spread of the two sets of results, 53 scored higher on the *SPM (ACER)*, 49 scored higher on the *SPM (British)*, and 6 scored the same on both versions of the test.

The mean raw score on the *SPM (ACER)* was 39.5, with a standard deviation of 8.1. Using the *ACER* norms collected in 1952-1953 this raw score mean transforms to an IQ range of 93-105 for the 16 to 16 years 11 months age range, which equates with a percentile ranking of 47 (i.e., 53% of the norms group would equal or better this score).

On the *SPM (British)* the mean score was similar to the *SPM (ACER)*, at 40. The standard deviation was 7.7. A percentile rank on the New Zealand standardization for this raw score was 3, using norms for the 16+ age range (i.e., 97% of the norms group would equal or better this score).

The differences between the raw scores were not significant ('t' = 1.67, df = 212). The results are contained in Tables (2) and (3) below.

TABLE 2 *Mean Raw Scores, Equivalent Percentile Ranks and Standard Deviations for 107 Corrective Trainees on Two Versions of the Standard Progressive Matrices*

	SPM (ACER)	*SPM (British)* and New Zealand Norms Supplement
Number of Subjects	107	107
Mean	39.5	40.0
S D	8.1	7.7
P R	47	3

TABLE 3 *Distribution of Scores According to Percentile Rank with Standard Progressive Matrices (New Zealand Norms Supplement)*

Below 20th Percentile	(raw score below 44)	78 subjects
21st to 50th Percentile	(raw score 45-50)	21 subjects
51st Percentile and Above	(raw score over 50)	8 subjects

The 1979 British standardization provides tables of expected scores for each subtest in relation to the total raw score. The tables are based on British data and are intended to give markers an idea of the reliability of a total test score, e.g., a subject scoring in the middle range would be expected to perform well on the earlier subtests but not so well on the later subtests. If the converse were true, then the reliability of the total score would be lowered. In the present study 32 subjects had one or more subtest scores outside the expected range for their total score.

DISCUSSION

In considering the results it should be remembered that the practice effects of retesting with the *Standard Progressive Matrices* or any other non-verbal test tend to be larger than with conventional intelligence or attainment tests (Vernon, 1969). Anastasi's comments noted in the introduction to this report regarding cultural differences and practice effects should be considered also. Conversely, of course, it is appreciated that motivational levels on having to repeat a test may drop. Other considerations include the possible effects of alcohol and/or drug abuse on performance in tests of an abstract nature such as the *Standard Progressive Matrices*, and possible generalised antipathy of many corrective trainees towards test-taking in general. While such possible influences should be evenly distributed over both sets of test results it must be accepted that the results can only be interpreted in a comparative rather than an absolute manner. It is the difference *between* the sets of percentile ranks rather than the actual rankings that are of most importance here.

The results of this investigation indicate that both forms of the *SPM* can be regarded as equivalent in relation to use by the prison population sampled in this study. However, the two sets of norms under investigation are not equivalent; a difference of over 40 percentile ranks can be found for the means of the two distributions of scores. The third question posed in the introduction to this report becomes the most crucial in the light of the difference in derived scores: which set of norms is the most appropriate for use on the New Zealand prison population?

Looking more closely at the New Zealand data, the norms were gathered on

school students . The sample number of those over 16 and in the fifth form was only 125. The *New Zealand Norms Supplement* (1984) notes a reduced reliability of the *SPM* for older students, due to the *ceiling effect* on the test and the consequent restricted variance of test scores. This however is unlikely to apply to the samples used in this study, given the positive skew. Given that at least 60% of subjects in this study left school at Form 4 or earlier, scores from this type of individual may not be included in the standardization, suggesting that the school population of 15 year olds and 16 year olds may not be a random sample of all 15 and 16 year olds.

The British manual (1979) does argue that the test should not necessarily work against those from disadvantaged backgrounds. As already mentioned, Anastasi (1976) takes a different viewpoint. Despite the above cultural considerations, *Research Supplement Number Two* (Court and Raven, 1982) additionally cites a study which, interestingly, is very similar to the mean raw scores found in the present investigation; McGurk, Bolton and Smith (1978) found a mean raw score of 40.66 for recidivists in a detention centre in the United Kingdom (difference was not significant between the two groups). The sample size was greater than the current study; the number of detainees tested was 315. West (1982) in a British longitudinal study of 400 working class males also noted that low *SPM* scores appeared to be significantly predictive of delinquency.

Noting the general acceleration in scores since the 1960's, indicated by the most recent British standardization, it is probable that the *ACER* norms of 1952 and 1953 are no longer valid. Performance on the *Standard Progressive Matrices (New Zealand Standardization)* by the subjects in this study must also seriously question general assumptions held in the Justice Department about the general mental ability of Corrective Centre detainees. Evidence here indicates that in relation to 16 year old secondary school students the bulk of these detainees come within the lowest 10%. There are some exceptions, with 8 scoring above the 50th percentile.

Given the above comments the Justice Department may like to consider the following recommendations:

(1) Abandon the *SPM (ACER)* on the grounds that the norms appear to grossly inflate the performance levels of corrective trainees.

(2) Introduce the *SPM (British)* in conjunction with the New Zealand norms supplement on the grounds of the existence of current New Zealand normative data, and more straightforward administrative procedures (this test is untimed).

(3) Review the Justice Department testing procedures to consider the place of the *SPM* in evaluating new corrective trainees (and perhaps other inmates also). This basis for such a review would be the doubts raised in current testing literature regarding the use of the *SPM* with different cultural groups, given that in the present study only 32% of the corrective trainees were European. The uses to which the test scores are put should also be considered.

Possible further research options include:

(1) Taking a sample of 100 recent *SPM (ACER)* corrective trainee scores and comparing them with the *SPM (ACER)* scores in the present study to detect any possible 'skew' in the present results.

(2) Administering the *SPM (British)* to approximately 100 corrective trainees with the same view as option (1).

(3) Replicating either option (1) or (2) with prison inmates to ascertain whether or not corrective trainee scores accurately reflect general prison inmate scores.

(4) Collecting normative information regarding specific adult groups such as occupational groups and/or groups of armed services personnel.

(5) Undertaking an analysis of standardized tests currently used in educational assessment procedures for new inmates.

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APPENDIX I

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INSTRUCTIONS FOR THE RAVENS TEST COMPARATIVE STUDY

Test Conditions

Please ensure that general procedures are as close as possible to the outline given in the pamphlet "How to give tests".

Test Supplies

You will be sent copies of the British Ravens Test booklet which differs from your present Australian booklet, answer sheets and administrations for the British tests and answer sheets for the Australian test. NZCER do not yet have the British test in good supply but I am told these will be available in about 2 weeks time. You will see that the Australian answer sheet has a good deal of additional information on it which we require as background to the test results. These sheets should be used only for the survey concerned.

Procedure

50 plus dual test results are needed from each of Tongariro Corrective Training Institution, Rangipo Corrective Training Institution, and Manawatu Prison. This should give a good mix of the type of person incarcerated.

Each group of new arrivals should be given both tests, alternating the order of each test for each group. There should be 5 days between the test and the retest.

Eg. first group tested is given the Australian test first then 5 days later the British test.

Second group is given the British test first then 5 days later given the Australian test.

Third group is given the Australian test first then 5 days later the British test.

And so on.